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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/710,012	06/11/2004	Chien-Chao Huang	2001.1531 / 24061.439	4011

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EXAMINER	
ISAAC, STANETTA D	
ART UNIT	**PAPER NUMBER**
2812	

DATE MAILED: 09/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/710,012	HUANG ET AL.	
	Examiner	Art Unit	
	Stanetta D. Isaac	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 August 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) *30-33* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,15-26 and 29* is/are rejected.

7)☒ Claim(s) *12,13,27 and 28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 June 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

LYNNE A. GURLEY
PRIMARY PATENT EXAMINER
TC 2800, AU 2812

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/18/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the election filed on 8/23/05. Currently, claims 1-33 are pending.

Election/Restrictions

Applicant's election with traverse of claims 1-29 in the reply filed on 8/23/05 is acknowledged. The traversal is on the ground(s) that the embodiments are not patentably distinct. This is not found persuasive because Claims 1-29 are drawn to a method and claims 30-33 are drawn to a device, which represent two patentably distinct invention.

The requirement is still deemed proper and is therefore made FINAL.

Claims 30-33 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 8/23/05.

Priority

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed on 10/14/04.

Information Disclosure Statement

The information disclosure statement (IDS) was submitted on 2/18/05. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Specification

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-11, 15-25 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Yeo et al., US Patent 6,492,216.

Yeo discloses the semiconductor method as claimed. See figures 1-9, and corresponding text, where Yeo teaches, pertaining to claim 1, a method comprising: providing a semiconductor alloy layer **2** on a semiconductor substrate **1** (figure 1; col. 3, lines 32-65); forming a gate structure **6** on the semiconductor alloy layer **2** (figure 4; col. 4, lines 57-62); forming source and drain regions **7** in the semiconductor substrate **1** on both sides of the gate structure (figure 5; col. 4, lines 63-67; col. 5, lines 1-25); removing at least a portion of the semiconductor alloy layer overlying the source and drain regions (figure 7; col. 5, lines 44-54); and forming a metal silicide region **10** over the source and drain regions (figure 8; col. 5, lines 54-62).

Pertaining to claim 2, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises etching the semiconductor alloy layer (col. 5, lines 50-54).

Pertaining to claim 3, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises exposing the semiconductor alloy layer to an etchant for a period of time until the semiconductor alloy layer overlying the source and drain regions is fully removed (figure 7; col. 5, lines 46-54).

Pertaining to claim 4, Yeo teaches, wherein the forming a metal silicide region comprises forming a metal silicide region having a metal selected from the group consisting of cobalt and titanium (col. 5, lines 25-42).

Pertaining to claim 5, Yeo, teaches, wherein removing at least a portion of the semiconductor alloy layer comprises using an anisotropic reaction ion etch to remove at least a portion of the semiconductor alloy layer (col. 5, lines 50-54).

Pertaining to claim 6, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises: altering at least a portion of the semiconductor alloy layer to a material receptive to a selective removal process (col. 5, lines 50-54); and selectively removing the altered semiconductor alloy layer form overlying the source and drain regions (figures 7 and 9; col. 5, lines 50-54 and lines 63-67; col. 6, lines 1-25).

Pertaining to claim 7, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises: oxidizing at least a portion of the semiconductor alloy layer to form a silicon oxide material receptive to a selective wet etch process (figure 4; col. 3, lines 65-67; col. 4, lines 41-62, ***Note***: the Examiner takes the position that the optional capping layer is not used); and selectively removing the altered semiconductor alloy layer from overlying the source and drain regions (col. 4, lines 57-62).

Pertaining to claim 8, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises: oxidizing at least a portion of the semiconductor alloy layer to form a silicon oxide material receptive to a selective dry etch process (figure 4; col. 3, lines 65-67; col. 4, lines 41-62, ***Note***: the Examiner takes the position that the optional capping layer is not used); and selectively removing the altered semiconductor alloy layer from overlying the source and drain regions (col. 4, lines 53-57).

Pertaining to claim 9, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises: consuming at least a portion of the semiconductor alloy layer to form a metal silicide material receptive to a selective wet etch process (figure 6; col. 5, lines 25-43); and selectively removing the altered semiconductor alloy layer from overlying the source and drain regions (col. 5, lines 25-43).

Pertaining to claim 10, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises: consuming at least a portion of the semiconductor alloy layer to form a metal silicide material receptive to a selective dry etch process (figure 8; col. 5, lines 44-62); and selectively removing the altered semiconductor alloy layer from overlying the source and drain regions (col. 5, lines 50-54).

Pertaining to claim 11, Yeo teaches, wherein removing at least a portion of the semiconductor alloy layer comprises: forming a metal layer over the semiconductor alloy layer overlying the source and drain regions (figure 6; col. 5, lines 25-43); annealing the metal layer and the semiconductor alloy layer and forming a metal silicide material **10** (col. 5, lines 30-35); and selectively etching the metal silicide material (col. 5, lines 35-43).

Pertaining to claim 15, Yeo teaches, wherein the semiconductor alloy layer comprises SiGe (col. 3, lines 30-60).

Pertaining to claim 16, Yeo teaches, wherein anneal the metal layer comprises performing a rapid thermal anneal process (col. 5, lines 30-35).

Pertaining to claim 17, Yeo teaches, wherein a method of forming a semiconductor device, comprising: forming a gate structure **6** on a semiconductor alloy layer **2** in a semiconductor substrate **1** (figure 1; col. 3, lines 32-65); forming source and drain regions **7** in the semiconductor substrate on both sides of the gate structure (figure 5; col. 4, lines 63-67; col. 5, lines 1-25); altering at least a portion of the semiconductor alloy layer overlying the source and drain regions (figure 7; col. 5, lines 44-54); and removing, at least partially, the altered semiconductor alloy layer overlying the source and drain regions (figure 7; col. 5, lines 44-54).

Pertaining to claim 18, Yeo teaches, further comprising forming a metal silicide layer over the source and drain regions **10** (figure 8; col. 5, lines 54-62).

Pertaining to claim 19, Yeo teaches, wherein removing the altered semiconductor alloy layer comprises etching the semiconductor alloy (figure 7; col. 5, lines 44-54).

Pertaining to claim 20, Yeo teaches, wherein removing the altered semiconductor alloy layer comprises exposing the altered semiconductor alloy layer to an etchant for a period of time until the semiconductor alloy layer overlying the source and drain regions is fully removed (figure 7; col. 5, lines 44-54).

Pertaining to claim 21, Yeo teaches, wherein forming a metal silicide region comprises forming a metal silicide region having a metal selected from the group consisting of cobalt and titanium (col. 5, lines 25-42).

Pertaining to claim 22, Yeo teaches, wherein removing the altered semiconductor alloy layer comprises using an anisotropic reaction ion etch to remove at least a portion of the altered semiconductor alloy layer (col. 5, lines 45-54).

Pertaining to claim 23, Yeo teaches, wherein altering and removing at least a portion of the semiconductor alloy layer comprises: oxidizing at least a portion of the semiconductor alloy layer to form a silicon oxide material receptive to selective etch process (figure 4; col. 3, lines 65-67; col. 4, lines 41-62, ***Note***: the Examiner takes the position that the optional capping layer is not used); and selectively removing the altered semiconductor alloy layer from overlying the source and drain regions (col. 4, lines 57-62).

Pertaining to claim 24, Yeo teaches, wherein altering and removing at least a portion of the semiconductor alloy layer comprises: consuming at least a portion of the semiconductor alloy layer to form a metal silicide material receptive to a selective etch process (figure 6; col. 5, lines 25-43); and selectively removing the altered semiconductor alloy layer from overlying the source and drain regions (col. 5, lines 25-43).

Pertaining to claim 25, Yeo teaches, wherein altering and removing at least a portion of the semiconductor alloy layer comprises: forming a metal layer rover the semiconductor alloy layer overlying the source and drain regions (figure 6; col. 5, lines 26-30); annealing the metal layer and the semiconductor alloy layer and forming a metal silicide material (col. 5, lines 30-35); and selectively etching the metal silicide material (col. 5, lines 35-43).

Pertaining to claim 29, Yeo teaches, wherein the semiconductor alloy layer comprise SiGe (col. 3, lines 30-60).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 12 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeo et al., US Patent 6,492,216 in view of Nagabushnam US Patent 6,171,959.

Yeo discloses the semiconductor method substantially as claimed. See preceding rejection of claims 1-11, 15-25 and 29 under 35 U.S.C. 102(b). In addition, Yeo shows, pertaining to claim 12, wherein removing at least a portion of the semiconductor alloy layer comprises: forming a metal layer over the semiconductor alloy layer overlying the source and drain regions (figure 6; col. 5, lines 25-43); annealing the metal layer and the semiconductor alloy layer and forming a disposable metal silicide material **10** (col. 5, lines 30-35); selectively etching the disposable metal silicide material overlying the source and drain regions (col. 5, lines 35-43). In addition, Yeo shows, pertaining to claim 26, wherein altering and removing at least a portion of the semiconductor alloy layer comprises: forming a metal layer over the semiconductor alloy layer overlying the source and drain regions (figure 6; col. 5, lines 25-43); annealing the metal layer and the semiconductor alloy layer and forming a disposable metal silicide material **10** (col. 5, lines 30-35); selectively etching the disposable metal silicide material overlying the source and drain regions (col. 5, lines 35-43).

However, Yeo fails to show, pertaining to claims 12 and 26, the steps of: forming a second metal layer; and annealing the second metal layer and forming a second metal silicide material.

Nagabushnam, teaches, in figures 1-8, and corresponding text, forming a second metal layer and annealing the second metal layer to form a second silicide (col. 5, lines 34-67).

It would have been obvious to one of ordinary skill in the art, to incorporate, the steps of: forming a second metal layer; and annealing the second metal layer and forming a second metal silicide material, in the method of Yeo, pertaining to claims 12 and 26, according to the teachings of Nagabushnam, with the motivation that, by including an additional metal layer to form silicide regions will help improve the conventional advantages of having a lower resistivity, thereby improving the ohmic contact of the source/drain regions.

Allowable Subject Matter

Claims 13, 14, 27 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The closest prior art of record, Yeo et al., US Patent 6,492,216 alone or in combination with Yeo et al., US Patent 6,492,216 in view of Nagabushnam US Patent 6,171,959, fails to show, the steps of:

Pertaining to claims 13 and 27, "implanting ions of at least one predetermined species into at least a portion of the metal-semiconductor alloy layer;"

Pertaining to claims 14 and 28, "implanting ions of at least one predetermined species into at least a portion of the metal layer;"

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stanetta D. Isaac whose telephone number is 571-272-1671. The examiner can normally be reached on Monday-Friday 9:30am -6:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stanetta Isaac
Patent Examiner
September 18, 2005

LYNNE A. GURLEY
PRIMARY PATENT EXAMINER
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